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EXAMINER	
ZERVIGON, RUDY	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/298,064
Filing Date: April 22, 1999
Appellant(s): XING ET AL.

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William Thomas Babbitt, Reg. 39,591
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed March 25, 2004.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The rejection of claims 1-7 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

The rejection of claims 17-20 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5,082,517	MOSLEHI	1-1992
6,130,118	YAMAZAKI	10-2000

P.J. Matsuo et al, "Role of N_2 addition on CF_4/O_2 remote plasma chemical dry etching of polycrystalline silicon", J. Vac. Sci. Technol. A, vol. 15, no. 4 (Jul/Aug 1997), pp.1801-1813

(10) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

Claims 1-4, 6, and 7 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over P.J. Matsuo et al. This rejection is set forth in a prior Office Action, mailed on July 29, 2003.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over P.J. Matsuo et al as applied to claims 1-4, 6, and 7 above, and further in view Yamazaki et al (USPat. 6,130,118). This rejection is set forth in a prior Office Action, mailed on July 29, 2003.

Claims 17-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Mehrdad M. Moslehi (USPat. 5,082,517). This rejection is set forth in a prior Office Action, mailed on July 29, 2003.

(11) Response to Argument

Applicant states (page 4) :

Independent claim 1 is not anticipated by and is prima facie not obvious over Matsuo, because Matsuo does not describe:

1) a second reaction chamber adapted to house a substrate for film formation.

In response to applicant's argument, and noting that all pending claims are apparatus claims, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

Further, that Matsuo's apparatus is "adapted" for "film formation" is derived directly from the Matsuo disclosure which teaches both etching and film formation processes - page 1805 – "In general, the decrease in Delta indicates the formation of a progressively thicker modified layer on the unperturbed silicon.....The formation of another layer takes place now. The time constant for this formation is just under 10 s....", and last paragraph, left column through first paragraph right column.

As such, Matsuo demonstrates that Matsuo's prior art structure is capable of performing the intended use of "film formation".

Applicant states (page 4,5) :

Independent claim 1 is not anticipated by and is prima facie not obvious over Matsuo, because Matsuo does not describe:

2) the first reaction chamber is coupled to the second reaction chamber and separated by a distance equivalent to the lifetime of nitrogen ions at a plasma generation rate.

‘

The Examiner agrees now and before that Applicant's claim 1 limitation of "separated by a distance equivalent to the lifetime of nitrogen ions at a plasma generation rate" is a dimensional limitation of an apparatus component. As a result, said limitation is a structural limitation of the pending apparatus claims as Applicant cites in the last paragraph of page 5. For this reason, the Examiner has stated, in support of his rejection of claim 1 and dependents that:

“

As shown in Figure 4, there are non-zero etch rates up to 125cm of first reaction chamber lengths. As such, lifetime of the nitrogen ions, up to and including these distances, are sufficiently long enough so "that the radicals react with the substrate in a process conversion step". However, although P. J. Matsuo et al teach all the structural limitations as described above, Matsuo's operation of the provided structure (Figure 1), as described in the reference, is not completely clear in anticipation that Matsuo's operation can provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate.

However, Matsuo states that the separation distance plays a major role in which reactive species survive and reach the processing chamber (Section III.B.2, Page 1803, second sentence) under

the variable conditions of flow control ("Mass Flow Controllers"; Figure 1) and microwave power (Section II - Experimental).

In the event that Matsuo's apparatus does not anticipate a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate, Matsuo's processing parameters of tube length, flow control, and microwave power can be optimized to meet the claimed property and function.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Matsuo to optimize the operation (variable length, flow rate, microwave power, gas identity, pressure; Section II – Experimental Apparatus and Procedure) of the apparatus to provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate.

Motivation for Matsuo to optimize the operation of the apparatus to provide a separation between chambers such that the separation is equivalent to the lifetime of the nitrogen ions at a plasma generation rate such that the radicals react with the substrate is to form a desired film. Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele , 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc . v. Biocraft Laboratories Inc. , 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied , 493 U.S. 975 (1989); In re Kulling , 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

" (Final Office Action - July 29, 2003)

Further, it is shown by Matsuo that charge neutral (non-ionic) gas species are controlled as a function of transport tube length (Figure 25, Section IV.B – page 1812) and that such a control

"play a major role in which species survive and reach the processing chamber." as taught by Matsuo (page 1803 – III.A.2).

Applicant states (page 5) :

‘

In addition, the description of the second reaction chamber as a chamber to house a substrate for film formation is a structural limitation identifying a class of chambers.

‘

In response, the Examiner disagrees on grounds stated above.

Applicant states (page 6) :

‘

First, Matsuo is not concerned with formation of a film; Matsuo is removing silicon.

‘

In response, the Examiner has addressed Applicant's position above in detail.

Applicant states (page 6):

‘

Matsuo, page 1813 does not say nitrogen is incorporated in a reaction layer or that nitrogen radicals react with a substrate in a film conversion step.

‘

In response, the Examiner cites Matsuo, on the same page 1813 who concludes:

“

Strong surface chemical changes are observed upon N_2 addition, although little nitrogen is incorporated in the reaction layer.

"

The above teaching of Matsuo clearly demonstrates that Matsuo's prior art structure is capable of performing the intended use of "film formation" in Applicant's pending apparatus claims. Further, Applicant apparently quotes from Matsuo's page 1813. Applicant states (page 6) that Matsuo says:

"

Even though nitrogen plays a profound role in the etching of silicon, it is not incorporated in a stable reaction layer.

"

In response, the Examiner has read Matsuo's page 1813 several times and has found no such content, either paraphrased or from direct quotation, in the cited reference. Further, the Examiner's above discussion rebut Applicant's apparent assertion.

Applicant's citation of additional prior art in Appendix B is appreciated. However, the Examiner believes that such a discussion only clouds the issues on appeal and the study of the cited prior art references.

In response to applicant's argument that there is no suggestion to combine the references of P. J. Matsuo et al as applied to claims 1-4, 6, and 7 above, and further in view of Yamazaki et al (USPat. 6,130,118), the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21

USPQ2d 1941 (Fed. Cir. 1992). In this case, the Examiner has recognized that the applied references provide teaching, suggestion, and motivation, as outlined in the rejections appealed. Specifically, motivation for substituting the P. J. Matsuo et al second reaction chamber for the Yamazaki et al substrate housing rapid thermal processing (RTP) chamber is drawn to the enhanced insulation and thermal conductivity of prepared films (column 6, lines 57-59) as taught by Yamazaki.

Applicant states (page 8) that Matsuo does not teach:

"

...means for providing a plasma of nitrogen to a reaction chamber substantially free of nitrogen ions such that radicals react with a substrate housed for film formation in a process conversion step.

"

In response, the Examiner has asserted that indeed Matsuo teaches equivalent means for generating a plasma from the nitrogen gas including means for providing "the" radicals. Applicant's specification specifically teaches the elements of:

i. First reaction chamber (300; Figure 3)

ii. Nitrogen gas source (313; Figure 3)

iii. Control valve (425; Figure 3)

iv. Microwave energy source (450; Figure 3)

While Matsuo's equivalent elements of:

v. First reaction chamber ("downstream tubing/lining", "Applicator" box portion of "downstream tubing/lining", Figure 1)

vi. Nitrogen gas source (N2 tank not labeled; Figure 1)

vii. Control valve ("mass flow controllers"; Figure 1)

viii. Microwave energy source ("microwave source "; Figure 3) and applicator ("applicator"; Figure 1)

As a result, Matsuo's prior art elements for generating a plasma from the nitrogen gas perform the identical function of generating a plasma from the nitrogen gas in substantially the same way, and produces substantially the same results as the corresponding elements disclosed in the specification (MPEP 2183).

In response to applicant's argument with respect to claim 17, Applicant states (page 9) that "Moslehi does not describe a system including a first reaction chamber and a second reaction chamber that are separated by distance equivalent to the lifetime of nitrogen ions at a plasma generation rate since that radicals react with a substrate in the second chamber in the film conversion step....Moslehi does not describe a machine-readable storage medium containing program instructions transferring plasma radicals of nitrogen via a distance equivalent to the lifetime of nitrogen ions into a chamber substantially free of ions.", recitations of the intended use of the claimed invention must result in structural differences between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Specifically, the Examiner has demonstrated that the Moslehi structure is capable of performing the intended use as stated in prior office actions:

"

The control of the composition of neutral and reactive species, and it's importance to plasma processing, is taught by Mehrdad M. Moslehi (column 1, lines 46-68; column 2, lines 37-42; column 4, lines 9-14; column 12, lines 56-68).

"

As such, Moslehi demonstrates that Moslehi's prior art structure is capable of performing the intended use of "a first reaction chamber and a second reaction chamber that are separated by distance equivalent to the lifetime of nitrogen ions" by employing Moslehi's controls as cited by the Examiner:

"

i. a system controller (40) configured to control the introduction of a gas from the gas source into the first chamber (column 12, lines 65 – column 13, line 14; column 13, lines 57-68, 33-43) and to control the introduction of an energy from the energy source (column 5, lines 43-52)

ii. a memory coupled to the controller comprising a computer readable medium having a computer-readable program embodied therein for directing operation of the system (column 5, lines 43-52; column 14, lines 3-20), the computer readable program comprising:

iii. instructions for controlling the gas source (column 14, 3-20) and the energy source (column 14, lines 3-20) to convert a portion of a gas supplied by the gas source into a plasma comprising plasma nitrogen ions and radicals (column 4, lines 9-14; column 10, lines 55-60, definition of plasma) and to deliver the plasma to the second chamber substantially (column

4, lines 9-14; column 11, lines 54-63; column 1, lines 46-52) free of nitrogen ions to react with a substrate in the second chamber in a process conversion step

"

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Rudy Zervigon
Examiner
Art Unit 1763

6/9/4

Rudy Zervigon
June 9, 2004

Conferees
Gregory Mills (SPE 1763)
Glenn Caldarola (SPE 1764)
Rudy Zervigon (Examiner 1763)

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